

CLAIMS

1. A display apparatus comprising:

a pixel including a plurality of sub-pixels
5 capable of representing a plurality of gradation
levels; and

a driver which receives an input data, and
outputs a plurality of data signals to said pixel
based on said input data to control said plurality
10 of sub-pixels,

wherein when a first sub-pixel of said
plurality of sub-pixels represents one of a minimum
gradation level and a maximum gradation level of
said plurality of gradation levels, a second sub-
15 pixel of said plurality of sub-pixels adjacent to
said first sub-pixel represents other than the
other of said minimum gradation level and said
maximum gradation level.

20 2. The display apparatus according to claim 1,
wherein said plurality of sub-pixels carries out
gradation representation by using two gradation
levels of a first gradation level of said plurality
of gradation levels and a second gradation level of
25 said plurality of gradation levels at a time.

3. The display apparatus according to claim 2,
wherein said first gradation level is different by
one level from said second gradation level.

5 4. The display apparatus according to claim 2,
wherein said driver comprises:

a gradation voltage generator which
receives a first set of bits in said input data,
and generates a first gradation voltage
10 corresponding to said first gradation level and a
second gradation voltage corresponding to said
second gradation level based on said first set of
bits; and

a selector which receives a second set of
15 bits in said input data together with said first
gradation voltage and said second gradation voltage
generated by said gradation voltage generator, and
selects one of said first gradation voltage and
said second gradation voltage to be sent to each of
20 said plurality of sub-pixels as one of said
plurality of data signals based on said second set
of bits.

5. The display apparatus according to claim 2,
25 wherein said driver comprises a gradation voltage
generator which receives a first set of bits in
said input data, generates a first gradation

voltage corresponding to said first gradation level
and a second gradation voltage corresponding to
said second gradation level based on said first set
of bits, and outputs said first gradation voltage
5 and said second gradation voltage as said plurality
of data signals, and

each of said plurality of sub-pixels
comprises a selector which receives a second set of
bits in said input data together with said first
10 gradation voltage and said second gradation voltage
outputted from said gradation voltage generator,
and selects one of said first gradation voltage and
said second gradation voltage based on said second
set of bits.

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6. The display apparatus according to claim 4,
wherein said driver further comprises:

an input signal interchange unit which
receives said input data and selects one of a first
20 mode and a second mode of gradation representation;
and

a memory which stores a plurality of bits
of data,

wherein in said first mode, said input
25 signal interchange unit outputs a third set of bits
in said input data to said gradation voltage
generator and a fourth set of bits in said input

data to said memory, and said memory outputs said fourth set of bits to said selector, and

in said second mode, said input signal interchange unit outputs a fifth set of bits in
5 said input data to said gradation voltage generator and a sixth set of bits in said input data to said memory, and said memory outputs said sixth set of bits to said selector.

10 7. The display apparatus according to claim 5, wherein said driver further comprises:

an input signal interchange unit which receives said input data and selects one of a first mode and a second mode of gradation representation;

15 and

a memory which stores a plurality of bits of data, wherein

in said first mode, said input signal interchange unit outputs a third set of bits in
20 said input data to said gradation voltage generator and a fourth set of bits in said input data to said memory, and said memory outputs said fourth set of bits to said selector provided for said each of said plurality of sub-pixels, and

25 in said second mode, said input signal interchange unit outputs a fifth set of bits in said input data to said gradation voltage generator

and a sixth set of bits in said input data to said memory, and said memory outputs said sixth set of bits to said selector provided for said each of said plurality of sub-pixels.

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8. The display apparatus according to claim 7, wherein said pixel further comprises a calculator which receives said sixth set of bits outputted from said memory, performs a calculation based on
10 said sixth set of bits, and outputs a calculation result to at least one of said plurality of sub-pixels.

9. The display apparatus according to claim 4,
15 wherein said driver further comprises an input signal converting unit which receives said input data, outputs a quotient obtained by dividing said input data by a natural number to said gradation voltage generator, and outputs a residual obtained
20 by dividing said input data by said natural number to said selector.

10. The display apparatus according to claim 4, wherein said driver further comprises:
25 an input signal converting unit which receives said input data and selects one of a first

mode and a second mode of gradation representation;
and

a memory which stores a plurality of bits
of data, wherein

5 in said first mode, said input signal
converting unit outputs a quotient obtained by
dividing said input data by a natural number to
said gradation voltage generator, and outputs a
residual obtained by dividing said input data by
10 said natural number to said memory, and said memory
outputs said residual to said selector, and

in said second mode, said input signal
converting unit outputs a sixth set of bits in said
input data to said memory, and said memory outputs
15 said sixth set of bits to said selector.

11. The display apparatus according to claim 5,
wherein said driver further comprises:

an input signal converting unit which
20 receives said input data and selects one of a first
mode and a second mode of gradation representation;
and

a memory which stores a plurality of bits
of data, wherein

25 in said first mode, said input signal
converting unit outputs a quotient obtained by
dividing said input data by a natural number to

said gradation voltage generator, and outputs a residual obtained by dividing said input data by said natural number to said memory, and said memory outputs said residual to said selector provided for
5 said each of said plurality of sub-pixels, and

in said second mode, said input signal converting unit outputs a sixth set of bits in said input data to said memory, and said memory outputs said sixth set of bits to said selector provided
10 for said each of said plurality of sub-pixels.

12. The display apparatus according to claim 2, wherein said driver divides said input data into m frames of data, and scans each of said plurality of
15 sub-pixels m times to represent said first gradation level p times and said second gradation level q times, wherein said p and said q are integers equal to or more than 0, said m is equal to a sum of said p and said q, and values of said p
20 and said q depend on said each of said plurality of sub-pixels.

13. The display apparatus according to claim 3, wherein said driver divides said input data into m
25 frames of data, and scans each of said plurality of sub-pixels m times to represent said first gradation level p times and said second gradation

level q times, wherein said p and said q are integers equal to or more than 0, said m is equal to a sum of said p and said q, and values of said p and said q depend on said each of said plurality of
5 sub-pixels.

14. The display apparatus according to claim 4, wherein said driver divides said input data into m frames of data, and scans each of said plurality of
10 sub-pixels m times to represent said first gradation level p times and said second gradation level q times, wherein said p and said q are integers equal to or more than 0, said m is equal to a sum of said p and said q, and values of said p
15 and said q depend on said each of said plurality of sub-pixels.

15. The display apparatus according to claim 1, wherein a number of said plurality of sub-pixels is
20 n (n is an integer equal to or more than 1), and an area ratio of said plurality of sub-pixels is $1:2^1:2^2:\dots:2^{n-1}$.

16. The display apparatus according to claim 1,
25 wherein a number of said plurality of sub-pixels is n (n is an integer equal to or more than 2), and an

area ratio of said plurality of sub-pixels is
1:1:2¹:2²:...: 2ⁿ⁻².

17. The display apparatus according to claim 13,
5 wherein a number of said plurality of sub-pixels is
n (n is an integer equal to or more than 2), and an
area ratio of said plurality of sub-pixels is
1:1:2¹:2²:...: 2ⁿ⁻².

10 18. The display apparatus according to claim 13,
wherein said plurality of sub-pixels have a same
area.

19. A method of gradation representation in a
15 display apparatus, comprising:

representing a plurality of gradation
levels on a pixel including a plurality of sub-
pixels; and

controlling said plurality of sub-pixels
20 such that when a first sub-pixel of said plurality
of sub-pixels represents one of a minimum gradation
level and a maximum gradation level of said
plurality of gradation levels, a second sub-pixel
of said plurality of sub-pixels adjacent to said
25 first sub-pixel represents other than the other of
said minimum gradation level and said maximum
gradation level.

20. The method of gradation representation according to claim 19, wherein said plurality of sub-pixels carry out gradation representation by using two gradation levels of a first gradation level of said plurality of gradation levels and a second gradation level of said plurality of gradation levels at a time.

21. The method of gradation representation according to claim 20, wherein said first gradation level is different by one level from said second gradation level.

22. The method of gradation representation according to claim 20, further comprising:

scanning each of said plurality of sub-pixels m times to represent said first gradation level p times and said second gradation level q times,

wherein said p and said q are integers equal to or more than 0, said m is equal to a sum of said p and said q , and values of said p and said q depend on said each of said plurality of sub-pixels.

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